with the winding, even after long exposure at high temperature.

Some electric furnaces, embodying many of the points above referred to, have recently been put on the market by Messrs. A. Gallenkamp and Co., Ltd., London, and in the several designs available the needs of the chemist have been fully considered. The construction of a single-tube furnace is shown in Fig. 1. The lagging is provided by four slabs of a mixture of magnesia and asbestos, while the central space surrounding the wound tube is filled with powdered quartz. Electric furnaces for research work, and particularly for use at high temperatures up to 2500° C., may be obtained from Mr. Chas. W. Cook, of Manchester. He also lists a simple type of wire-wound combustion furnace for fixing on an ordinary retort stand. A similar furnace is supplied by Messrs. Baird and Tatlock, London, and should prove useful for many chemical operations.

OILS AND FATS.

CHEMICAL industry in Britain is now passing through a very critical period; many people are realising its importance, and it is being compared, not always to its advantage, with the German chemical industry. Whilst it is true that as regards the manufacture of dyes and pharmaceutical chemicals we have much leeway to make up, the same cannot be affirmed of all branches, even of the organic chemical industry. It is desired here to indicate briefly the present position of the oil and fat industry in relation to the application of science in it.

One illustration of the backwardness of applied chemistry in Britain which is often quoted by the would-be reformer is the lack of adequate text-books in English. In the great industry of oils and fats this reproach is certainly not justified; indeed, in Lewkowitsch's work[1] the industry possesses a text-book which is second to none, and has been translated more than once. Moreover, a challenge can be issued on behalf of this industry as one in which British foresight and enterprise have led the world. Whilst this success is in part due to the financial genius and organising ability of the founders of our great concerns, it is none the less principally based on the application of science, and probably in no other British industry has chemistry had such scope as in that connected with fats and oils. There is, perhaps, no better illustration of the chasm between the college and the factory, the existence of which was deplored by Dr. Forster at the annual meeting of the Society of Chemical Industry. The college has no idea of the knowledge of fats and oils possessed by the industry; writing with inside knowledge, this may be declared to be at least a decade ahead of the published literature. The colleges know not even the names of their industrial colleagues, or at least, like the proverbial prophets, these are without honour in chemical circles at home.

The third volume of Dr. Lewkowitsch's classic work gives a very complete summary of the technology of manufactured oils and fats, and even the most eminent expert will be certain to learn from almost any of its chapters. Unfortunately but a tithe of the knowledge which the writer really possessed of the actual working of the industry is recorded in its pages, doubtless because much of it had been acquired in confidence. As a consequence this, like other similar works, gives but an imperfect idea of the actual stage of development to which the industry has attained, and is to that extent disappointing when the manufacturer of to-day turns to it to help him out of his difficulties. All will agree, however, that Lewkowitsch's book is an integral part of the oil and fat industry, which his whole-hearted zeal and hard work did so much to advance, and that his all too early decease was a great misfortune.

The raw materials of the fat and oil industry are strikingly varied. At first limited in number, their scarcity and the consequent increase in value as the demand for soap and margarine grew have prompted a world-wide search to increase them, and chemical science has played an essential *rôle* in their development. Thus in early days soap was made in small works from tallow of local origin. As the works grew larger, tallow was imported to Europe from the large cattle and sheep raising districts in the New World. At the same time vegetable oils from the tropical countries began to be used for soap-making, and since the margarine industry also has learnt how to utilise such vegetable fats, the whole world has been laid under contribution to supply them. As most are the products of trees, their cultivation on any scale has not yet been successful, the exceptions being the oils from linseed, which is grown in temperate climates, and the soy bean of the East. Linseed oil is too unsaturated either for use in margarine or soap, but as a drying oil it has no equal. Until the discovery of the hardening process for saturating fats, the highly unsaturated whale oil and fish oils were of very limited application.

The manufacture of soap, an operation of great antiquity, is based on the simplest of chemical reactions, and even to-day in some countries it is carried out in a most primitive manner. This is in striking contrast to the up-to-date methods of the great British soap manufacturers, who have learnt how to make their soaps neutral so as to be without action on the skin or the most delicate fabrics; how to blend the fats which compose them so as to make soaps having any desired qualities; and even how to make the fullest use of the advance of physical chemistry, including such apparently academic branches as the phase rule.

Soap primarily requires a hard fat for its raw material; and with the margarine industry making the same request, the demand outstripped the supply. The situation might have become serious

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[1] "Chemical Technology and Analysis of Oils, Fats, and Waxes." By Dr. J. Lewkowitsch. Edited by P. H. Warburton. Fifth edition. Vol. iii. Pp. viii+483. (London: Macmillan and Co., Ltd., 1915.) Price 25s. net.

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from the point of view of the price of the raw materials if the success of the hardening process had not made the softer, unsaturated oils also available.

Few, if any, developments of recent years have been more remarkable and more truly chemical than that connected with the so-called hardening of fats—the realisation on an industrial scale of that very simple exercise in organic chemistry, the reduction of an unsaturated double bond by means of hydrogen. How simple it seems, and yet the leading expert on the chemistry of fats said not many years ago that it could not be done. Even Sabatier, the discoverer of the efficacy of metallic catalysts in the hydrogenation of vapours, expressly stated that his process failed with liquids. Normann's first patent for the hydrogenation of liquid fats was based, as all experimental work must be, on work done in the laboratory; there he was successful, and though his patent was crudely drawn—and who would have done better?—the great idea was there. Yet the successful application on the large scale took many years of arduous work and much capital expenditure. The German firm, Leprince and Sievke, who first bought Normann's process, made little of it, and parted with it to Joseph Crosfield and Sons, of Warrington, in whose hands it has been brought to its present success. The innumerable patents on the subject are little more than variations of the original idea of Normann—acts of piracy, for the most part, arising out of the present unsatisfactory condition of the patent laws. Yet a perusal of the most recent book on hydrogenation leaves the reader almost ignorant of the existence of the Warrington firm.

Not so many years ago glycerine was an almost worthless bye-product of the soap industry, and the spent lyes from the soap-pan were originally concentrated for the sake of the salt they contained. To-day the lyes are purified with the utmost care, and the glycerine is concentrated, distilled, and refined until the article sold is of quite remarkable purity considering its low price. The practical problem—one of chemical engineering—is to evaporate water from the dilute lyes until a crude glycerine is obtained at the cheapest possible cost. The contrast between the original shallow open pans heated by a fire and the elaborate multiple-effect vacuum evaporators with salting arrangements which are used to-day is a striking one. It is typical of the advances made in chemical engineering, a branch of the chemical profession which is as important industrially as that of the laboratory worker.

The stearine candle industry has lost ground owing to the powerful competition of gas and electricity in towns and the development in the use of cheaper paraffin, but it is still of importance both in England and abroad. The old empirical methods of preparing and blending the raw materials have given way to modern processes based on the knowledge of the chemical properties of the substances concerned.

Equally important as chemical achievements must rank the great developments in the processes of refining oils so as to render vegetable oils in particular available for edible purposes. This branch of the subject was described at some length in NATURE of April 8 (vol. xcv., p. 145).

Space forbids more than brief reference to the industries concerned with lubricating oils or with boiled oils for making varnishes and paints. The latter are almost wholly concerned with linseed oil, and their problems are connected with oxidising and changing the oils.

The outlook for the future in these industries in Britain may be faced with confidence. The tendency to aggregate the production in large factories enables a competent staff of chemists to be employed, and avoids the pitfalls consequent in the practice of rule-of-thumb methods in small concerns. Competition ensures the constant striving to invent and develop new and cheaper processes, and at the same time safeguards the public interests by providing them with a cheap article, the low price at which fat and oil products are retailed at the present day being one of the most remarkable testimonies to the development of the industry.

THE DYE FAMINE IN AMERICA AND THE PROPOSED REMEDY.

RECENT issues of the *Scientific American* (November 6 and 13) contain articles by Prof. T. H. Norton, of the Bureau of Foreign and Domestic Commerce, Washington, dealing with the prevailing shortage of dyes in the United States. For some months after the outbreak of the European war, American importers were able to secure an almost normal supply of synthetic dyes, but during the last seven months, owing to the embargo on the shipment of German dyes to neutral countries, only 50 tons of such colouring matters have reached America, together with small amounts of dyes of Swiss origin.

Before the war, American dye factories employed not more than 400 workmen and produced annually 3000 tons of dyes, these colours being prepared chiefly from intermediate coal-tar products made in Germany.

After a systematic examination of the dye problem by the Department of Commerce, the Secretary of Commerce, on September 30, outlined the policy of the present administration in regard to the protection to be afforded to American chemical enterprise against unfair attacks by foreign rivals. In the meantime, prompt and resolute decisions had been made by the industrialists, and considerable investments were made in new plant, two new companies having an authorised capital of 400,000*l.* and 3,000,000*l.* respectively. The output of American coal-tar colours has been doubled and will soon be trebled, while the production of benzene and toluene has increased fivefold. Owing to the extensive manufacture of explosives, it is difficult at present to secure large quantities of these hydrocarbons for colour production. But twelve firms have nevertheless embarked on the manufacture of aniline, the Edison Company now turn-

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